

Medicine Cabinet

How to manage head lice

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Competing interests:
None declared

West J Med
2000;172:342-345

People are infested by 3 types of lice: body lice (*Pediculus humanus* var *corporis*), head lice (*P h* var *capitis*), and crab or pubic lice (*Phthirus pubis*). Lice have evolved with their human hosts and have developed life cycles and anatomy best suited to those particular areas of the body.¹ Body lice are associated with severe systemic diseases such as typhus and trench fever. Infestation with crab lice most commonly follows intimate or sexual contact.² Of the 3 lice types, head lice get the most attention because they are thought to be highly prevalent and to be developing resistance to commonly used pediculicides. The treatment of head lice is a multimillion dollar industry.³ In this review, we look at this treatment.

THE EXTENT OF THE PROBLEM

The Centers for Disease Control and Prevention (CDC) report that 6 to 12 million people in the United States are infested each year with head lice.⁴ Children aged 3 to 10 years in preschool and elementary school are most likely to have infestations. Girls have an increased risk because of more frequent head-to-head contact. African Americans have fewer reported infestations compared with other ethnic groups, which may be due to differences in hair thickness and curl. Head lice are found across all socioeconomic classes.

THE LIFE OF A HEAD LOUSE

Head lice are thought to be transmitted mainly through head-to-head contact. Fomites—clothing and other articles that transmit disease, such as combs, hats, helmets, bedding, and other personal items—have been implicated in their transmission, although this is not universally accepted.^{1,5}

Head lice are obligate ectoparasites that live on human skin and can survive only on human blood; they do not infest other animals.¹ They need several meals of blood each day and die if away from the host head for more than 2 days.¹ They are wingless and cannot jump but climb quickly from hair to hair when the hair is dry. When the hair is wet, lice hardly move, making them vulnerable for identification and removal by gloved hands or with the aid of a specially designed fine-tooth comb.⁶

The adult female louse firmly attaches 7 to 10 eggs a day to human hair using a glue-like, water-insoluble substance. These eggs are deposited close (1 mm) to the scalp so that the heat and moisture from the host's head incubates the egg.⁵ Eggs laid farther away from the scalp are not likely to be viable. They are most commonly found in the occipital and postauricular regions, but may be found anywhere on the head. By 7 to 10 days, when the nymph emerges from the egg, it is close enough (within 6 mm) to the scalp to easily have its first meal of blood. The distance

Summary points

- Head lice are transmitted mainly through head-to-head contact
- Only people with active infections should be treated
- Over-the-counter pediculicides are the agents of choice
- Manual removal of lice eggs and nits with a fine-tooth comb should accompany pediculicide treatment
- A second treatment is usually required in 7 to 10 days to kill any newly hatched lice

nits or hatched eggs are from the scalp can be used as an indicator of how long the person has been infested.^{7,8} Lice nymphs undergo 3 molting stages before achieving adulthood at 7 to 10 days.^{6,9} Adult lice live about 30 days.

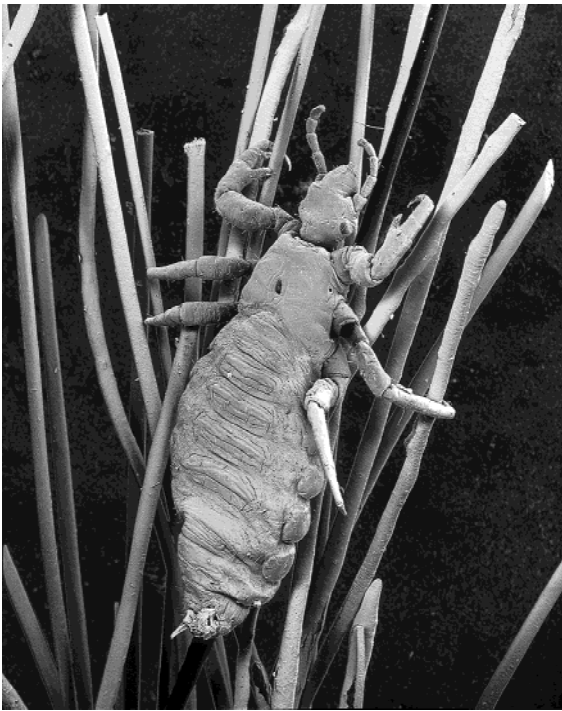
People with infestations of head lice usually have no more than 10 to 12 live lice at a time but can have many hundreds of unhatched eggs and nits.^{6,9} Head lice bites and saliva may elicit a host immune response.^{1,4} The resulting pruritus and sensation of “something crawling on the head” are the most common symptoms. Constant scratching may result in scalp excoriations and secondary bacterial infections. People with infestations may also present with fever, lymphadenopathy, headache, rash, malaise, and increased irritability.^{4,10} Most infestations are asymptomatic, however.

TREATMENT OVERVIEW

Many experts agree that before treatment, there must be positive identification of live lice and unhatched eggs, not just nits. Dandruff, dried hairspray, lint, sand, and hair casts, which have all been mistaken for eggs and nits, are much more easily removed. It is best to search for head lice when the hair is wet, using a strong light and a magnifying glass. A fine-tooth comb and clear tape can help capture and identify the insect.⁷ Once head lice infestation has been confirmed, treatment involves a multipronged approach that includes pediculicidal agents, mechanical removal, and possibly environmental measures (although there is not widespread agreement on this) to prevent further transmission and reinfestation.

Once an infestation of head lice is confirmed, a pediculicide should be carefully applied, following the labeling on the package. All household members with active infestation should be treated simultaneously. Although various pediculicides are approved for use in young children, the CDC does not recommend their use in children 2 years old or younger; only manual removal of lice, eggs, and nits is recommended for this age group.

The use of conditioners should be avoided before ap-



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The head louse is 2 to 3.5 mm long and lives only 3 weeks ($\times 30$ magnification)

plying a pediculicide because they coat the hair and may protect the lice. According to the CDC, if the lice are moving slowly or dead 8 to 12 hours after treatment, then the pediculicide is probably effective.⁴ If, however, the lice are as active as before treatment, then an alternative agent may be required. Ideally, 2 to 3 days should elapse after pediculicide treatment before the hair is washed. Repeating the treatment 7 to 10 days after the initial treatment is generally recommended to kill any newly hatched lice. Pruritus may persist for 7 to 10 days after successful treatment and should not be misconstrued as treatment failure.⁹

Most experts advocate the physical removal of viable eggs in conjunction with the use of a pediculicide to prevent reinfestation from emerging nymphs that may have survived treatment. Moreover, many schools enforce a “no-nit” policy that prevents a child’s return to class until the hair is completely free of eggs and nits. The use of a sturdy fine-tooth comb—usually included in the pediculicide kit—is recommended for this time-consuming, tedious process. The hair should be combed at least every 2 to 3 days until no more eggs or nits are observed. Combing should start with small sections of wet hair, working from the scalp outwards, although back-combing to dislodge eggs and nits may be helpful.^{9,11} The process may take an hour or more each day for several days. For young children, playing their favorite videotape during the combing can be used to distract them.¹¹ All household members should be inspected for infestation.

Fomite control is a controversial aspect of lice management. The natural history of head lice suggests that they rarely survive off the host for more than a couple of days and that herculean efforts to treat the environment are often time-consuming, disruptive, and perhaps, unwarranted.^{1,5} However, many experts continue to endorse strategies to minimize fomite transmission, despite the minimal risk.^{4,7,8,12} The CDC recommends that all clothing and bedding in contact with the infested person during the 2 days before pediculicide treatment be laundered with hot water and placed in the dryer using the hot cycle. All nonwashable items should be quarantined in plastic bags for 2 weeks should any surviving eggs hatch in that time period. Disinfection of combs and brushes in hot water or alcohol is also recommended. Although various home fumigation products and insecticide sprays are marketed, no experimental or epidemiologic data are available to warrant their use.

UNCONVENTIONAL TREATMENTS

Unconventional remedies include oil-based treatments, gasoline or kerosene, and head shaving.¹¹ Oil-based remedies such as olive oil are thought to immobilize and suffocate the lice. No reliable data support these claims, and these substances may be difficult to remove and may be irritating to the eyes and skin. Gasoline and kerosene have caused severe burns.¹³ Head shaving is traumatic and unwarranted.

TOPICAL AGENTS

Pediculicides are lousicidal or toxic to the nymphs and adult lice. The degree that they are ovicidal or toxic to the developing embryo varies with each agent. During the first 4 days of its existence, the developing embryo lacks a central nervous system and is impervious to agents that attack the central nervous system.¹² Products with long residual effects are more likely to be ovicidal. Although most agents can quickly kill nymph and adult lice, no product can ensure 100% ovicidal activity. Therefore, physical removal of eggs and nits following any pediculicide treatment is essential. Available agents are listed in the table.

First-line topical agents are available over-the-counter and are devoid of major toxicities. These products contain either pyrethrins combined with piperonyl butoxide or the more potent synthetic pyrethroid, permethrin.^{4,8} Natural pyrethrins are extracts from the flower of the pyrethrum plant, *Chrysanthemum cinerariaefolium*.¹⁴ These agents kill lice by excessively stimulating their nervous systems. The addition of piperonyl butoxide synergizes pyrethrin activity by delaying its detoxification by the louse.¹⁴ Products containing pyrethrin do not have residual pediculicidal effects. For this reason, retreatment is necessary 7 to 10 days later to kill any newly hatched lice. The more potent

*Available agents for management of head lice**

Generic	Brand	Availability	Directions	Repeat application	Side effects
Recommended agents					
Permethrin 1%	Cream: NIX® Creme Rinse	Over the counter	Hair should be washed and towel dried. Apply sufficient amount to hair and leave for 10 minutes. Rinse.	May not be necessary. Repeat dose if live lice are observed 7 days or more after initial treatment to kill any newly hatched lice.	Itching, redness, or swelling of scalp may occur; may cause eye irritation; avoid in patients with history of allergy to chrysanthemum or ragweed.
Pyrethrins 0.33% and piperonyl butoxide 4%	Shampoo: RID®, Pronto®, A-200® (various manufacturers & formulations available)	Over the counter	Apply sufficient amount to dry hair and leave for 10 minutes. Add enough water to form lather. Rinse.	Repeat dose is necessary in 7 to 10 days to kill any newly hatched lice.	Itching, redness, or swelling of scalp may occur; may cause eye irritation; avoid in patients with history of allergy to chrysanthemum or ragweed.
Lindane 1%	Shampoo (various manufacturers)	Prescription only	Apply sufficient amount to dry hair and leave for 4 minutes. Add enough water to form lather. Rinse.	Repeat dose if live lice are observed 7 days or more after initial treatment to kill any newly hatched lice.	Use with caution. Potential for systemic absorption and central nervous system side effects: seizures, dizziness.
Malathion 0.5%	Lotion: Ovide®	Prescription only	Apply lotion to dry hair until thoroughly moistened. Rinse off after 8 to 12 hours.	Repeat dose if live lice are observed 7 days or more after initial treatment to kill any newly hatched lice.	Strong odor; alcohol vehicle is flammable and may cause irritation to eyes.
Alternative agents for consideration					
Permethrin 5%	Cream: Elimite®	Prescription only	Apply to dry hair and allow to remain overnight under shower cap	Not approved by the FDA for treatment of head lice.	
Ivermectin	Tablets (3 mg, 6 mg): Stromectol® (topical formulation not commercially available)	Prescription only	200 µg/kg by mouth as a single dose have been used for treatment of lice.	Not approved by the FDA for treatment of head lice.	

FDA = Food and Drug Administration.

*All treatments should be accompanied by physical removal with a fine-tooth comb to remove eggs and nits.

permethrin, unlike pyrethrins, remains active for 2 weeks.¹⁵ Therefore, retreatment with permethrin is generally not necessary because of its residual effects. For resistant cases, permethrin 5% cream (prescription strength) applied for an extended period—overnight under a shower cap—has been used.^{8,16}

When these first-line pediculicides have failed after proper application or if the person is allergic to ragweed or chrysanthemums, alternative agents are prescriptive lin-

dane or malathion. Lindane, or γ -benzene hexachloride, is a chlorinated hydrocarbon pesticide that was once the most common treatment of lice.¹⁶ The agent is slow-acting and has lousicidal and limited ovicidal effects.⁸ It, too, kills lice by excessively stimulating their nervous systems. Lindane can be systemically absorbed, and seizures and, in rare cases, deaths have been reported, primarily after gross misuse, overuse, or accidental or intentional ingestion. With reports of resistance and the availability of

safer, more effective alternatives, lindane is no longer considered a first-line agent.^{12,16,17}

Malathion, an organophosphate insecticide, was recently reapproved by the Food and Drug Administration for the treatment of head lice. It had been taken off the market for commercial reasons because of its objectionable odor, flammability, and long application time.¹⁸ Malathion is an irreversible cholinesterase inhibitor with rapid lousicidal and ovicidal effects.^{14,18} Malathion is available as a lotion that is applied to dry hair and left on for 8 to 12 hours. Because this formulation contains 78% isopropyl alcohol, the lotion and wet hair should not be exposed to flames or heat sources such as hair dryers. Stinging of skin and eye irritation may occur with use.

ORAL AGENTS

Ivermectin is an antiparasitic agent that is effective against several insects and nematodes such as *Onchocerca volvulus*, which causes river blindness, and *Strongyloides stercoralis*, a gastrointestinal nematode.¹⁹ These organisms die of tonic paralysis due to ivermectin. Brief reports and small open studies suggest that ivermectin, given as a single dose of 200 µg/kg, may be a safe and effective oral agent against scabies and head lice as well.²⁰⁻²² Because complete eradication of head lice was not observed in all cases, some researchers advocate a second dose in 10 days to kill any newly hatched lice.²⁰ Ivermectin topical solution has also been effective in eradicating head lice in a small number of patients.²³ Unfortunately, a topical preparation is not yet commercially available. Although experience with ivermectin for other parasitic diseases suggests it is relatively safe, a disturbing number of excessive deaths has recently been reported among elderly patients in a long-term facility who were treated with ivermectin for scabies.²⁴ In addition, safety data on its use in children weighing less than 15 kg and in pregnant and nursing women are not available.

The combination product of oral trimethoprim and sulfamethoxazole has also been cited, mainly in small observational studies and anecdotal reports, as an alternative to topical pediculicides.^{8,25} This antibiotic seems to kill the symbiotic bacteria found in the lice gut, which ultimately kills the lice.²⁶ However, the potential for allergic reactions and the risk for promoting bacterial resistance limit its widespread use for this indication.^{11,27}

RESISTANCE

Treatment failures to pyrethrins, permethrins, lindane, and malathion have all been reported.^{16,18,27} However, whether this is attributed to true reduced susceptibility of the lice to these agents or to poor compliance, incorrect application, or reinfestation has been much debated. Currently, the extent of the problem in the United States is hard to quantify.²⁸

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